Status of the Greater Amberjack, *Seriola Dumerili*, in the Southeastern United States Through 1995

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ABSTRACT

The condition of the U.S. Atlantic Ocean and Gulf of Mexico greater amberjack, *Seriola dumerili*, stocks are presented. Commercial landings of the Atlantic group ranged from 6,344 to 2,332,479 pounds from 1962 through 1995 and stabilized at 1.9 million pounds per year during the early 1990s. Gulf group commercial landings ranged from 5,616 to 2,337,329 pounds with greater variability than the Atlantic group over recent years. Recreational harvests showed more annual variability than commercial landings with significant declines in recreational catches for both stocks. Recreational catch declines may be partly related to federal and state bag limit regulations enacted in the early 1990s. Increases in average length observed in recent years in both stocks may be due to size limits adopted for commercial and recreational fisheries during the early 1990's. Recreational catch per unit of effort (CPUE) abundance varied without trend since 1981 while commercial abundance remained stable since 1993 for the Atlantic group. Recreational abundance of the Gulf group declined in the late 1980s concomitant with declining recreational catches however, recreational abundance remained stable since 1990 while catches continued to decline. Declining trends in commercial landings, recreational catches, and recreational CPUE began in the late 1980s for both groups and have continued through recent years for the Gulf group. Recreational CPUE remained stable in recent years. Larger changes in recreational catches and recreational abundance have occurred in the Gulf group than in the Atlantic group. Additional reductions in total annual harvest are expected with proposed changes in recreational bag limits and variable seasonal closures in the commercial fisheries. The relatively short time-series of information on changes in size, abundance, and total catch currently existing for the Atlantic Ocean and Gulf of Mexico greater amberjack stocks is a limiting factor to determine the true condition of the stocks.

KEY WORDS: Greater amberjack, *Seriola dumerili*, stock assessment, size/abundance trends

amberjack stocks, respectively.

MATERIALS AND METHODS

Catch statistics were obtained from the National Marine Fisheries Service (NMFS), Southeast Fisheries Science Center (SEFSC), Research Management Division (RMD). Protocol as defined in McClellan and Cummings (1996) and Cummings and McClellan (1996) for defining stock groups were used. The geographic boundary of these management units is defined as the intersection of the outer boundary of the U.S. EEZ and 83° 00'W longitude, proceeds north to 24° 35'N latitude (Dry Tortugas), east to Marquesas Key, then through the Florida Keys to the mainland. In this paper, the western central North Atlantic Ocean greater amberjack stock is called the Atlantic group and the Gulf of Mexico stock is called the Gulf group. Commercial landings (pounds) were obtained from NMFS, RMD statistics division. Florida landings were not stratified by month and statistical shrimp grid before 1977 or by gear after 1993. Commercial landings coded as caught in NMFS, statistical shrimp grids' 001.0 and 001.2 were included in the Atlantic stock 1962 - 1993. Landings coded as caught in NMFS, statistical shrimp grids' 002.0 - 021.0 and 001.1 were included in the Gulf stock 1962-1993. Florida commercial landings for 1994 and 1995 from Monroe county were included in the Atlantic stock. Recreational harvest by charterboat, private vessel, and shore mode, was obtained from the NMFS Marine Recreational Fisheries Statistics Survey (MRFSS). Headboat catches were obtained from the NMFS, Beaufort laboratory and recreational catches in Texas were obtained from the Texas Parks and Wildlife Department (TPWD).

Samples of individual sizes and weights from the recreational and commercial fisheries were recorded by port samplers for some fishing trips. Size and weight data were used to compute sample average weight and length, and the variance of each. Commercial landings were converted from gutted to whole weight using the NMFS conversion factor of 1.04 (G. Davenport personal communication). Total pounds landed was divided by the sample average weight of the catch sample to yield an estimate of total catch in numbers. Estimated total numbers of fish caught in the catch was apportioned over length according to the proportional distribution of fish at length in the sample. Length samples were assigned to catches according to year and fishery (commercial, recreational, headboat). Lack of sufficient temporal, geographical, and fishery resolution prevented using finer resolution in assigning samples to catches. Weight-length equation parameters were taken from Burch (1979) for the Atlantic group [Weight (lbs.) = 6.40×10^{-5} x fork length (mm) $^{2.842}$] and Manooch and Potts (in press) for the Gulf group [Weight (kg) = 5.3×10^{-8} x fork length (mm)$^{2.810}$].

Observations of CPUE abundance data measured as catch per angler (CPA), catch per hour fished (CPH), and pounds per trip were available from MRFSS

data from the most recent period in which stable landings occurred, 1993 through 1995 for the Atlantic stock, and 1992 through 1995 for the Gulf stock. Seasonal closures of two, three, and four month periods from February through May, the primary months of spawning were considered.

RESULTS

Commercial Landings

Greater amberjack commercial landings in the Atlantic group ranged from 6,344 to 2,332,479 pounds (lbs.) over the 34-year period (Figure 1a). Major increases in landings occurred between 1985 and 1991. Ninety percent of the Atlantic group annual landings were made in Florida. Most of the catch was taken on the east coast of Florida between Cape Canaveral and Miami. Significant catches were also made off Islamorada, Florida in an area known as the "Humps". Catches were made between March and June (Table 1), the main months of spawning (Berry and Burch 1979). Hook and line gear accounted for about 90% of total landings, with about 5% of landings being made by spearguns after 1986 (Table 2). Total annual landings of the Atlantic group declined about 18% from 1991 to 1993 but appear to have stabilized at 1.9 million lbs. since 1993.

Commercial landings of the Gulf group of greater amberjack ranged from 5,616 to 2,337,329 lbs. (Figure 1b) with large increases occurring between 1983 and 1988. Catches of the Gulf group were landed mainly on the west coast of Florida with substantial volume landed in Louisiana. Catches were made mainly off areas east of the Mississippi River by hook and line gear between April and September (Tables 3 and 4). Beginning about 1981, significant landings from bottom longlines appear in the records, contributing annually about 15% of the total Gulf group landings by the late 1980s. Total annual landings of the Gulf group declined by 51% to 1,087,628 lbs. in 1990 and again in 1991 to 828,880 lbs. Declines in landings were largest in Florida. Between 1991 and 1994 landings of the Gulf group showed significant increases, but declined 36% between 1994 and 1995 Landings have declined for the Gulf more dramatically than in the Atlantic.

Table 2. Total pounds landed (whole weight) commercially by gear type for the Atlantic Ocean greater amberjack stock in the southeastern United States, 1977-1995. Florida landings were not available by gear after 1993. All landings reported from NMFS, statistical shrimp grids' 001.0 and 001.2 were included in the Atlantic Ocean stock 1977-1993. Florida (west coast) landings from Monroe county for 1994-1995 were included in the Atlantic Ocean stock.

Gear	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Hook & Lines	70075	44640	62391	48825	61818	158870	116743	205081	172314	461127
Surface Longlines	0	0	0	0	0	0	0	0	0	0
Bottom Longlines	0	0	0	0	0	464	765	1173	2016	29110
Dive Gear	0	0	0	0	0	0	0	0	0	13067
Gillnets	0	0	0	0	0	495	20	0	53	386
Trawls	162	0	1591	27807	44631	35851	14794	4587	5666	8619
Seines	0	0	0	0	0	0	0	1800	0	0
Unclassified	0	0	0	0	0	0	629	0	0	2723
All Gears	70237	44640	63982	76632	106449	195680	132952	212641	180050	515032

Gear	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
Hook & Lines	1344337	1235388	1203391	1848049	2213449	2067069	1767218	324114	331235	13275007
Surface Longlines	0	0	137	0	71	606	42	17	259	1132
Bottom Longlines	6364	4858	6618	21155	20575	26371	22692	7698	23336	144085
Dive Gear	30107	18373	70807	18066	81153	120181	108815	38371	12319	498192
Gillnets	633	1551	1399	412	1275	1644	971	694	577	9724
Trawls	2342	4461	2952	117	155	114	654	0	0	145884
Seines	0	97	0	0	8	0	0	29	40	1974
Unclassified	6357	1237	7252	26857	15793	1240	689	1626235	1539675	3225764
All Gears	1390140	1265965	1292556	1914458	2332479	2217225	1901081	1997158	1907441	17301764

Table 4. Total pounds landed (whole weight) commercially by gear type for the Gulf of Mexico greater amberjack stock in the southeastern United States, 1977-1995. Florida landings were not available by gear type after 1993. All landings were reported from NMFS, statistical shrimp grids' 002.0-021.0 and 001.1 were included in the Gulf of Mexico stock, 1977-1993. Florida (west coast) landings from Monroe county for 1994-1995 were included in Atlantic Ocean stock.

Gear	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Hook & Lines	125216	165360	161304	188374	236062	204674	259433	519376	731059	1042457
Surface Longlines	0	0	0	0	0	0	0	0	0	0
Bottom Longlines	0	0	2912	5283	24950	43634	50646	68802	124171	228436
Dive Gear	0	0	0	0	0	0	0	0	0	515
Gillnets	9360	2184	4680	2373	286	728	107	69	306	129
Trawls	0	0	0	0	0	0	0	0	1760	160
Seines	0	0	0	2220	0	0	0	0	0	0
Unclassified	0	0	312	0	0	0	7	0	0	0
All Gears	134576	167544	169208	198251	261298	249036	310193	588247	857296	1271697

Gear	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
Hook & Lines	1398429	1930952	1849368	876855	510211	925400	801427	5761	5030	10894291
Surface Longlines	0	1286	4762	1081	90	5423	466	0	0	13108
Bottom Longlines	285775	367336	334537	191054	99407	103293	44990	338	0	1747128
Dive Gear	19436	29272	21692	6340	13060	16416	23300	0	0	129516
Gillnets	22	6	0	0	0	1218	1064	38	87	22528
Trawls	5404	8477	6059	156	0	51	255	0	0	22162
Seines	0	0	0	11757	0	0	0	27	43	14047
Unclassified	54432	0	4903	1202	208947	423461	571464	1163141	898760	3426629
All Gears	1763498	2337329	2221321	1088445	831715	1475262	1542966	1169305	903920	16269410

Recreational Harvest

Total annual recreational greater amberjack harvest of the Atlantic stock ranged from 14,911 fish in 1982 to 100,326 fish in 1987 (Figure 2a). Harvest include catches by private anglers, shore fishermen, charterboats, and headboats. Recreational catches showed more annual variability than did commercial landings. Recreational catches of the Atlantic group showed a declining trend in the private, charter, and shore fisheries since 1987 except during 1994 (Figure 2b). The annual rate of decline ranged from 10% to 30% since 1987. Fish were caught recreationally mainly by fishermen in Florida, and before 1991 private anglers caught about 25% more than charterboat fishermen. Since 1991 however, charterboat fishermen have caught about 50% more than private anglers except in one year, 1992. Catches by the headboat fleet traditionally have been much lower than the other recreational fisheries, averaging 10% to 15% of the total recreational harvest (Figure 2b). Recreational catches suggest a declining trend in the headboat fishery as in the private, charter, and shore fisheries.

Recreational harvest of the Gulf stock ranged from about 61,669 in 1984 to 688,011 fish in 1987 (Figure 3a). Variability between the Gulf group fisheries was high and much greater than for the Atlantic group. Charterboat anglers have traditionally landed more fish of the Gulf group with most of the harvest coming from Florida west coast anglers. After the 1987 peak in recreational harvest, a significant declining trend is apparent through 1995 in the headboat fishery (83%) and in the charter/private angler catches (90%) (Figure 3b). Declines in recreational harvest have been larger for the Gulf group.

Biostatistical Sampling

Individual length and weight sampling of recreational and commercial fisheries occurred at a low level over the entire history of recorded catches. Recreational gears were sampled more intensely than commercial gears in nearly all years in both stocks and headboat anglers were always sampled at a higher rate than either commercial or recreational fishermen. Sampling rates ranged from 0.1% to 0.7% for the Atlantic group private/charter fisheries while the headboat fishery was sampled at a rate of about 1.6% since 1986 (Table 5a). Commercial length samples were almost nonexistent before 1990. During 1992 and 1993, sampling of commercial fisheries increased to 1.6%, however, subsequent years sampling rates declined by more than 50% to 0.6% and remain at that level. Between 1988 and 1995, the total numbers of fish sampled in the headboat catch remained stable however, headboat catches declined dramatically. The effect of this was to create artificial stability (or increase in some years) in the headboat fishery sampling rate. The number of individuals sampled in the commercial and other recreational fisheries declined steeply over the same period while commercial and private and charterboat catches declined more gradually.

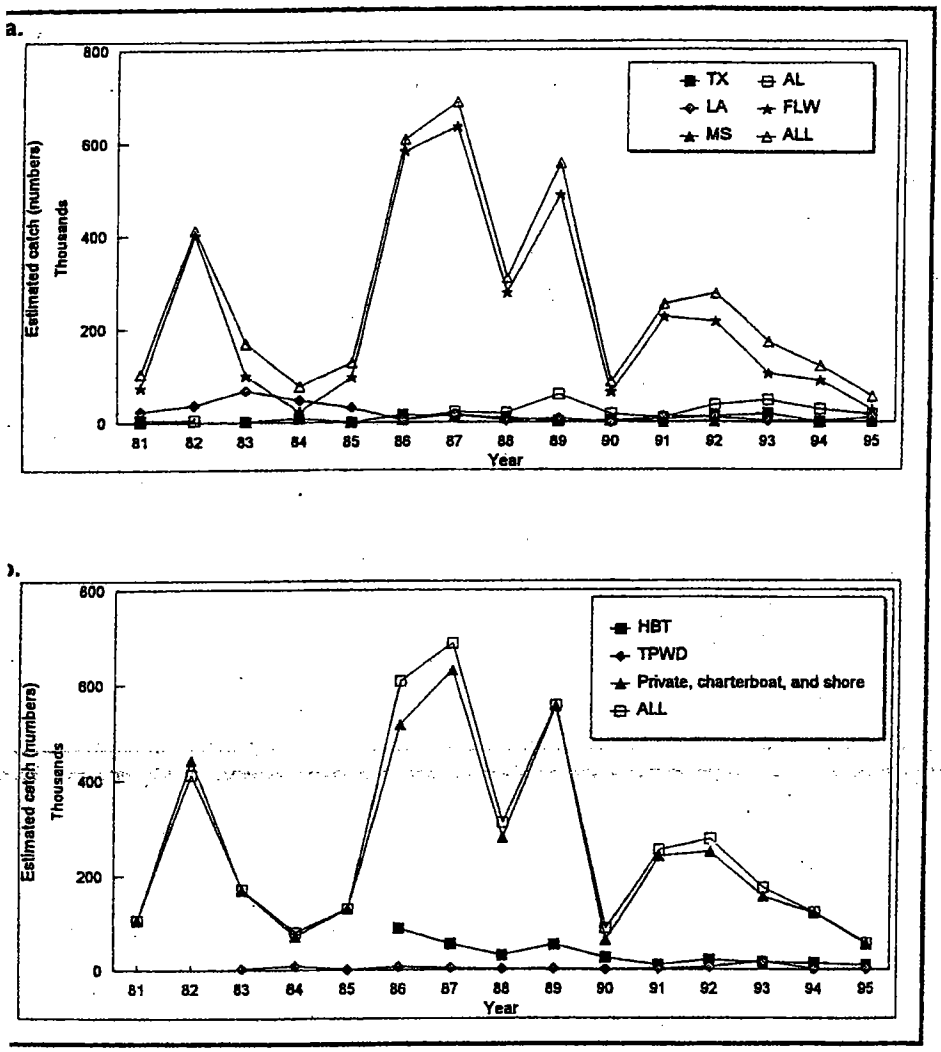

Figure 3. Estimated recreational catch (numbers) of the Gulf of Mexico greater amberjack stock by a) year and state and b) year and fishery.

Average length of the Atlantic group of greater amberjack caught by private anglers, charterboat fishermen, and shore fishermen was variable from 1978 through 1988. Recreational average size showed a decline in 1988 and has remained at 90 cm since 1989 (Figure 4a). Sample sizes for 1995 were low (n = 60 fish measured). Average length from headboat catches declined from 1974 to 1983, was variable without trend from 1984 through 1990, and showed slight increases beginning around 1991. Since 1993, headboat average length has been stable at 83 cm. Average length of commercially landed fish showed a continued increase from 1984 through 1992 and has been variable since. Average weight was more variable and subject to low sample sizes (Figure 4b).

Length sampling rates of the Gulf group ranged from 0.0% to 0.9% for the private and charterboat fisheries and from 0.7% to 3.2% for the headboat fishery (Table 5b). Commercial length samples were sparse before 1987 and erratic after that. The rate of sampling was about 1% until 1990 with sampling declining from 2% to 1.1% between 1992 and 1993, increasing between 1993 and 1994, and declining again in 1995 by 50%.

Average length of Gulf fish caught by private anglers, charterboat fishermen, and shore anglers in the Gulf was variable without trend from 1981 through 1987 (Figure 5a). Average length showed slight increases between 1988 and 1994 and averaged 78 cm in 1995. Recreational sample sizes were low in 1995. Average length landed by headboat anglers was variable without trend between 1980 and 1990 and increased since 1991 averaging 79 cm in 1995. Average length of fish landed by commercial vessels increased continuously from 1984, except in 1988. Average length from the commercial fishery was 97 cm in 1995. Average weight varied more and was subject to low sample sizes (Figure 5b).

Estimated Total Numbers Caught

Biostatistical length samples, commercial landings and recreational harvest data were sufficient to estimate total catch of the Atlantic group since 1985 (Table 5a). Total catch by the commercial, recreational (private, charter, shore) and headboat fisheries ranged from 89,226 to 198,975 fish declining since 1991. About 91,656 fish were caught in 1995, a 43% decline from the 1994 value. The 1995 commercial catch was 58% of that in 1991 and has varied without trend since 1992, averaging about 60,000-70,000 fish annually. Most of the decline in total harvest was from the recreational sector. Harvest by recreational charter, private, and shore anglers varied from 14,907 to 78,342 fish from 1981-1995, declining to 27,582 fish in 1995. The decline in recreational catch

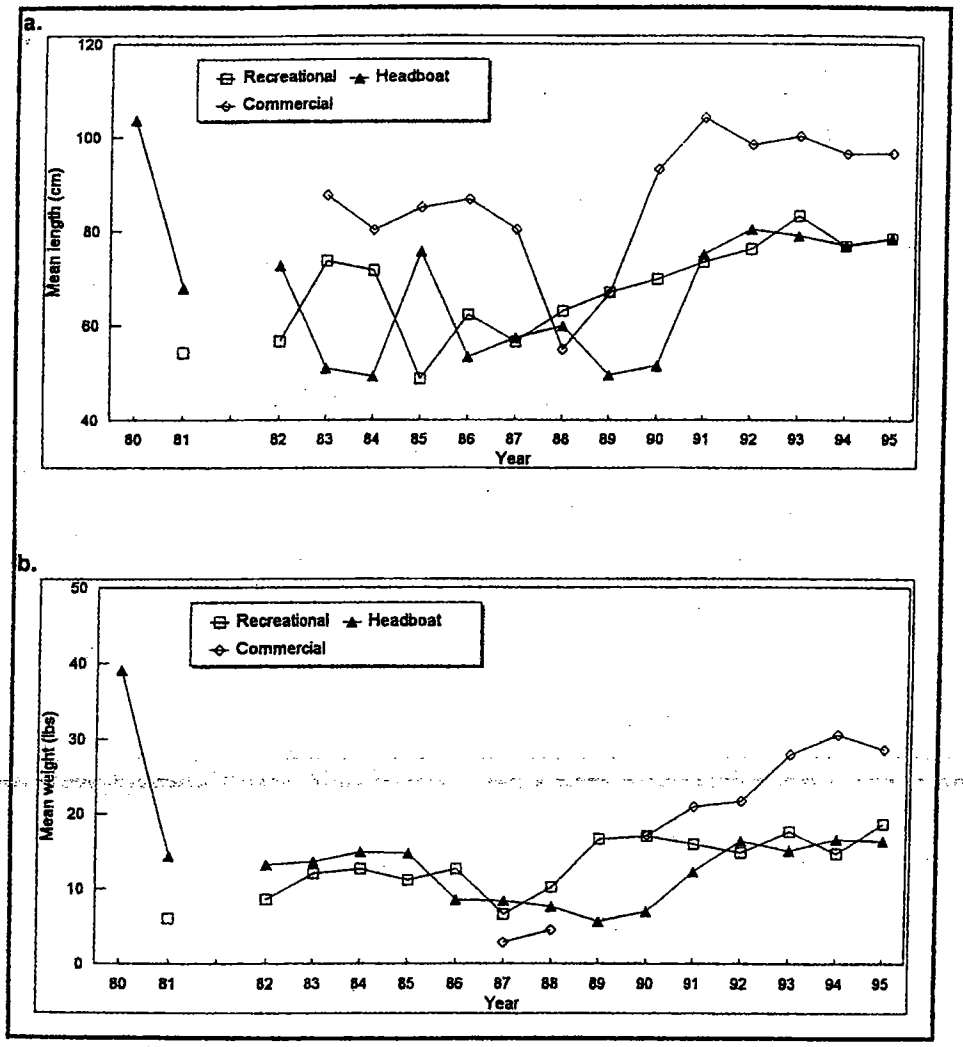

Figure 5. Observed a) mean length (cm) and b) whole weight (lbs.) by year and fishery of the Gulf of Mexico greater amberjack stock.

while CPA declined about 50% in the headboat fishery from 0.8 to 0.3 fish per angler. TPWD recreational data suggest CPA varied without strong trend between 1983 and 1995 while CPH declined about 50% from 1985-1995 from 0.9 to 0.2 fish per trip (McClellan and Cummings, 1996).

The GLM model fit to the Gulf group recreational private/charterboat CPA data included separate terms for year, month, state, and fishery, all variables that were significant in explaining CPA ($p = 0.0001$, $df = 29$). Standardized CPA from the private/charterboat fisheries was variable with a decline occurring from 1991-1994 (Figure 6b). Headboat CPA data were fit to a model containing terms for year, month, and state; all significant factors in the GLM model ($p = 0.0001$, $df = 27$). Results suggest headboat CPA declined from 1986 through 1990 and varied without trend after that. Headboat CPA declined from 1986 through 1990 and has been stable since 1991. The amount of the total variation in CPA explained by the GLM models was reasonably high for the headboat data (56%) but lower (39%) for the private/charterboat data. Values for 1984 and 1985 are in question because of the large confidence intervals.

Commercial CPUE Abundance Patterns

Commercial reef fish vessel logbook data suggest catch rates of the Atlantic group were variable over the period 1992-1995, depending upon the gear used and the area of capture, varying from about 100 to 650 pounds per trip. Hook and line gear were used most often to capture greater amberjack in the Atlantic group however, powerheads and spearguns were also used. Within a gear category CPUE remained constant across years except handlines that suggest a slight decline from 1994 to 1995.

A GLM model fit to the commercial logbook data included terms for year, month, gear, and port of landing, all significant terms in explaining CPUE ($p<0.005$, $df = 9,495$). The amount of the total variation for the Atlantic group explained by the GLM regression model was 12%. Regression results suggest a decline in CPUE (pounds per trip) of Atlantic fish landed between 1992 and 1993 and stable CPUE at 110 lbs. per trip since 1993. This trend is similar to that observed for unstandardized commercial CPUE of all gears combined through 1994 (Figure 7b).

Commercial CPUE in the Gulf group varied over the period 1992 through 1995 depending upon the gear and area of capture ranging from about 100 to 300 pounds per trip (Figure 8a). Annual un-adjusted CPUE remained stable within a gear category during this period through 1994. Most of the logbook records showed hook and lines were the predominant gear used, with many trips coming from longlines.

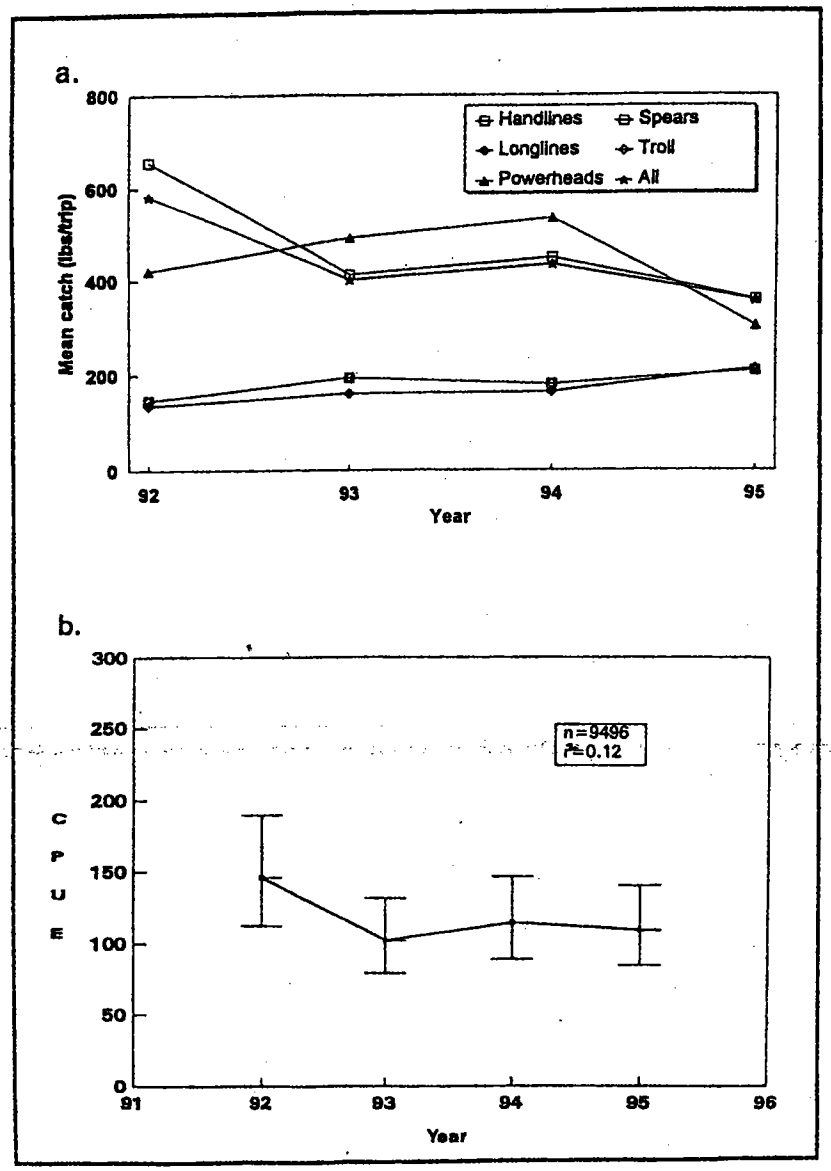

Figure 7. Commercial CPUE (lbs. per trip) from logbooks by year for the Atlantic Ocean greater amberjack stock a) unadjusted and b) standardized by GLM.

Table 6. Estimated reduction (percent) in the recreational catch for the a) Atlantic Ocean and b) Gulf of Mexico greater amberjack stock (1995 data only) for several bag limit options. N equals number of interviews available.

a. **Atlantic Ocean**

Bag Limit	Data Source/Fishery		
	MRFSS		NMFS
Option	Charter	Private	Headboat
1	18	42.9	3.8
2	5.6	26.5	1.4
3	0	18.4	0.7
4	0	10.2	0
5	0	6.1	0
N	58	16	1030

b. **Gulf of Mexico**

Bag Limit	Data Source/Fishery		
	MRFSS		NMFS
Option	Charter	Private	Headboat
1	18	42.9	3.8
2	5.6	26.5	1.4
3	0	18.4	0.7
4	0	10.2	0
5	0	6.1	0
N	58	16	1030

fish trap fishery during the years in which significant landings increases were observed for greater amberjack.

Some decline observed in commercial landings of the Gulf group may be explained from the introduction of minimum size limits established in 1990. Restriction of commercial sales of greater amberjack during April and May to the recreational three fish per trip limit may have also affected total landings of the Atlantic group although landings have been stable since about 1993. Under-reporting is believed to have been a significant problem until the early 1990s particularly for the Atlantic group (Ben Hartig, unpublished data). Significant quantities of landings from Florida east coast ports were shipped to markets on Florida's west coast. Cored and logged landings are also believed to have occurred in large quantities during the late 1980s. Failure to convert these landings may have introduced bias into total annual harvest data. Total landings would be underestimated for the earlier years producing a more optimistic picture of the trend in declining landings in recent years.

Recreational catches showed declines in harvest in recent years for both the Atlantic and Gulf stocks. The start of the decline and the precise level of decline is difficult to identify for either stock with certainty because of large variability in the catch estimates present in the MRFSS estimates. Long-term trends in recreational catches should be viewed with caution because estimates of catch for private angler, charterboat, and shore fisheries contain large variance in several years (1980, 1981, 1984, 1985). Uncertainty is likely due to the low number of intercepts available in the private angler and charterboat mode for the MRFSS survey. A change in the ability of fishermen and samplers to identify greater amberjacks from other *Seriola* species may have lowered the uncertainty in later years. Further reductions in recreational harvest are expected in Florida state waters as a one fish per person bag limit was implemented July 1, 1996 in Monroe county, Florida for all amberjack species. In addition, a proposed one fish per person per trip bag limit in Gulf of Mexico federal waters may produce additional declines in total recreational harvest for the Gulf group in all states making it more difficult to evaluate changes in stock condition.

Average length was variable during the early years in both the Atlantic and Gulf stocks, while in recent years an increasing trend in size is apparent in the major fisheries. Species identification problems may account for part of the variability in size during early years. Minimum size regulations introduced in 1990 for both stocks include a 71 cm fork length recreational and a 91-cm fork length commercial (71 cm core length) size limit. Increases in observed mean length in the Atlantic and Gulf group fisheries reflect these regulations and are viewed as positive changes in the fishery as many fish were captured prior to the size of first spawning during the developing years of the fishery.

A change in the targeting behavior of recreational anglers away from greater

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FIMA to CAMS Conversion Results

FIMA		CAMS	
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		Project Title:	SE COOPERATIVE RESEARCH (PPA)
		Proj. Begin Date:	19-SEP-01
		Proj. End Date:	
Phase:	RD	Task:	PRD
		Task Title:	RED DRUM PROJECT IN GOM
		Task Begin Date:	19-SEP-01
		Task End Date:	
		Fund:	01
		Program:	02-08-01-023

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